Chapter 14
Dredging Support Surveys

14-1. General Scope

This chapter provides an overview on hydrographic surveys performed in support of the Corps dredging program. Types of dredging templates and surveys are defined. This chapter also provides background information concerning dredging contract clauses that deal with measurement and payment surveys. For detailed guidance on dredging procurement policies and practices, refer to the appropriate regulations applicable to dredging--e.g., FAR, DFARS, EFARS, and ER 1130-2-520, "Navigation and Dredging Operations and Maintenance Policies."

14-2. Background

The U.S. Army Corps of Engineers performs hundreds of surveys annually that are used to monitor dredging in over 25,000 miles of navigable waterways, which includes deep and shallow draft channels and harbors. During Fiscal Year 1999, the Corps dredged 373 million cubic yards of material. Approximately 88% of this work was done by contract dredging, involving over 250 contracts. The Corps-owned Minimum Dredge Fleet performed the remainder of the work. A variety of hydrographic surveys are conducted in support of these dredging operations--both for Corps-owned dredging equipment and contracted dredging operations. Dredging measurement and payment surveys are usually performed by Corps survey crews; however, they may be conducted by independent Architect-Engineer survey firms or the dredging contractor's survey crews. Most dredging contractors also maintain an independent survey capability to monitor dredge performance and progress, and to check the official Corps measurement and payment surveys. Dredging support surveys typically require high degrees of accuracy since they are used to estimate annual dredging budget and quantity requirements, determine dredging contractor payment, and to certify final acceptance and clearance of a project to its authorized navigation depth. In many instances, the adequacy and accuracy of these hydrographic surveys are reviewed and challenged by contractors with resultant disputes involving: the amount of material removed for payment; unexcavated shoal material remaining above the required dredging grade; or the adequacy of acoustic and density measurements of unconsolidated materials in the channel bottom. In order to minimize these disputes and construction contract claims, the accuracy standards, procedural technical specifications, and other quality control policies covered in previous chapters of this manual must be rigorously followed. All dredging surveys require the utmost in accuracy standards, quality control, and timeliness, as explained below.

14-3. Types of Dredging Support Surveys

The following paragraphs describe some of the surveys used to monitor dredging operations in river and harbor navigation projects. Figure 14-1 depicts a section view of the typical dredging templates and surveys.

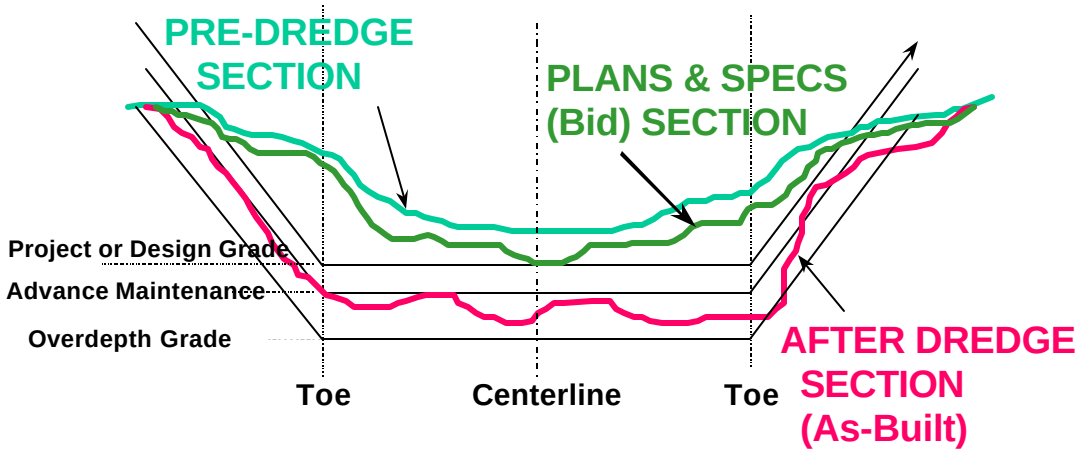

Figure 14-1. Typical dredging templates and payment surveys

a. Project condition or plans & specifications surveys. Hydrographic surveys are performed over Corps projects on at least an annual basis. On rapidly shoaling projects, more frequent surveys may be performed--e.g., daily surveys are performed on Southwest Pass at the mouth of the Mississippi River where almost continuous dredging is performed. These "Project Condition Surveys" are used to assess needs for maintenance dredging, and may be used as the basis for the estimated quantities in dredging contract documents from which bids are made. The hydrographic survey drawings and estimated quantities shown in the contract documents (generally termed Plans & Specifications Surveys) shall have been made as close to the solicitation advertisement date as possible--typically within 120 days or less, depending on estimated shoaling rates.

b. Pre dredge surveys. Once a dredging contract is awarded and dredging plant and equipment is on site, surveys are performed over the contract area as close to the start of dredging as possible; generally within 14 days prior to commencement of work in the reach (i.e., Acceptance Section) to be dredged. These Pre Dredge surveys are often referred to as "Before-Dredging" surveys, or "BDs." Plots of Pre Dredge surveys and related quantities requiring excavation are required within two (2) days of completion of the surveys. The quantities from the Pre Dredge surveys are compared with the quantities that were estimated in the contract solicitation documents--i.e., the Plans & Specifications surveys.

c. After dredge, final clearance, and acceptance surveys. After-Dredging (AD) surveys are performed as soon as possible after dredging in a reach or acceptance section is completed; generally within five (5) days or less. Final survey plots and quantity computations are required within two (2) days of the survey in order to release the dredge to other work. See ER 1130-2-520, "Navigation and Dredging Operations and Maintenance Policies." Normally the After-Dredging survey suffices for assessing contract

performance, and the project, or an individual acceptance section, is contractually "accepted" based on this survey. In many cases, the After Dredge survey reveals not all material has been removed and subsequent dredging and surveys must be performed before final clearance/acceptance is verified. Often, repeated full-coverage channel sweep surveys must be performed to locate and remove material or man-made objects above grade. Channel sweep surveys may be made with multi-transducer boom sweeps, multibeam (swath) transducers, or bar-sweeps (sweep rafts). In many instances, the accuracy of these surveys are challenged by contractors who are understandably anxious to have the project accepted as "clear to grade" so they can move their dredge plant to another project and receive final payment. Typically, disputes over remaining material above the required depth involve the positional and depth measurement accuracy capabilities of the survey. These disputes often involve shoal material or objects that are well less than the accuracy tolerances of most echo sounding equipment--i.e., 0.2 ft to 0.5 ft. Other disputes involve remaining shoal material 5 to 10 feet inside the channel toes--also near the tolerances of dredging or hydrographic survey positioning. In many cases, repeated surveys of these shoal areas yield different results, or may not agree with those performed by the dredging contractor's survey crew. In accordance with the contract, the Corps Contracting Officer can unilaterally direct the contractor to remain on site removing any shoal areas that were indicated on the After-Dredging survey(s)--or "alleged shoals" from a contractor's standpoint. Payment for this disputed extra work may be difficult to resolve, and often is decided years later by the Engineer Board of Contract Appeals or in other claims or appeals processes.

d. As-Built drawings. These various after dredge surveys are used to form the "as-built" survey drawing for the project, which is furnished to navigation interests. This project clearance information is used by the U.S. National Oceanic and Atmospheric Administration (NOAA) to update their nautical charts of the area, the U.S. Coast Guard (USCG) for notice to navigation interests, and many private and public interests, such as local ports and harbors and pilots associations.

e. Contractor access to government records. In accordance with standard practice, dredge contractors are provided full and open access to all survey data obtained by the Corps, for all surveys listed above. This includes analog records (e.g., echosounder traces), digital data (e.g., digitized depth data, GPS correctors), and all other recorded information used to correct hydrographic survey data (e.g., bar check records, velocity measurements, tide corrections) or to perform volume computations (CADD generated data files). In addition, dredge contractor representatives are normally on board the survey vessel to observe all surveys performed for payment or acceptance. This provides the contractor with the opportunity to assess the technical adequacy and accuracy of surveys performed by the Corps; and hopefully resolve any alleged or real deficiencies before dredging progresses.

14-4. Variation in Estimated Quantities

Dredging contracts involving payment based on hydrographic surveys contain a "Variation in Estimated Quantities" (VEQ) clause that is invoked when significant disparities between these surveys occurs. This clause provides for a modification of the unit price originally bid due to a significant change (usually ± 15%) between the estimated and actual quantities. A contract modification is prepared which adjusts the quantity and cost in the contract documents due to the variation in work. Negotiation of a revised unit price for the work is often difficult and contentious, especially when the Pre Dredge survey indicates less material than that estimated in the contract bid documents. Thus, both the contract Plans & Specifications survey and the Pre Dredge survey must be timely and accurate, especially in areas subject to rapid shoaling. When the VEQ clause is used, the government estimates the quantity of units of work to be performed, and the solicitation and contract provide a unit price for the work.

14-5. Dredge Contracting and Production Measurement Methods

There are two general methods for contracting dredging work: (1) Unit Price contracts, and (2) Firm Fixed Price (FFP) contracts. Unit price contracts are preferred by the Corps and are far more predominant than fixed price contracts. All types of these dredging contracts require detailed hydrographic surveys to monitor construction progress, performance, payment, acceptance, and/or project clearance. A short description of these contracts follows since hydrographic survey support and accuracy requirements will vary somewhat with the type of contract payment method.

a. Unit price--in-place volume measure. A majority of dredging contracts in the Corps are awarded with payment based on in-place volume measure. These contracts determine payment based on the amount of material removed from a navigation channel (or placed, as in beach renourishment projects). This measurement is performed by comparing before and after dredging hydrographic surveys, and deducting any material that has been unexcavated or over-excavated, as indicated by the "non-pay" areas in Figure 14-2. Normally for beach renourishment projects, payment is based on before and after beach placement profiles, not from quantity excavated. Payment is made based on the unit price bid by the contractor--typically cubic yard (CY) or cubic meter. Use of in-place volume measurement requires that the Corps has the capability to "perform payment surveys in a timely and accurate manner" and can "assure that the surveys specified in the contract are sufficient to verify that the contract requirements are met."

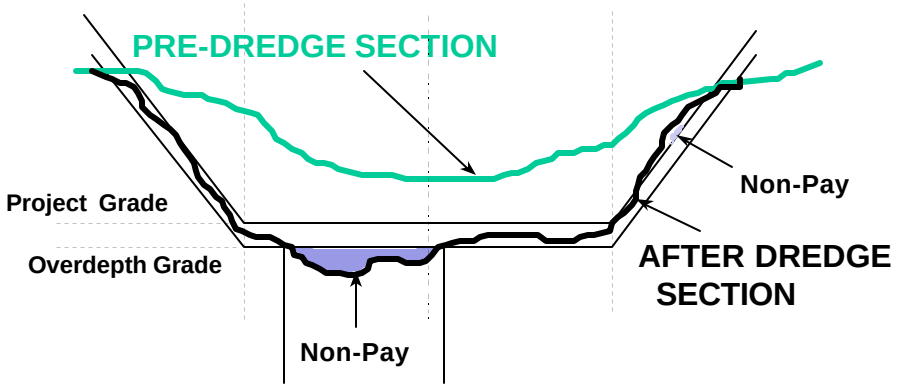

Figure 14-2. Typical Pre/Post Dredge Section

b. Unit price--area measure. Area measure contracts are used in channels where depths of cut are relatively small and constant, and the area of dredge cut is the determining price factor, not depth of the "face" cut. The bid unit area (in square yards) is a channel section between fixed stations--thus the term "Station Dredging" for this method of dredging--see Figure 14-3. Final hydrographic surveys are performed to ensure clearance to grade and acceptance of work--quantities may be computed however payment is made

for the fixed section of work completed and accepted. These contracts are typically used in smaller navigation canals.

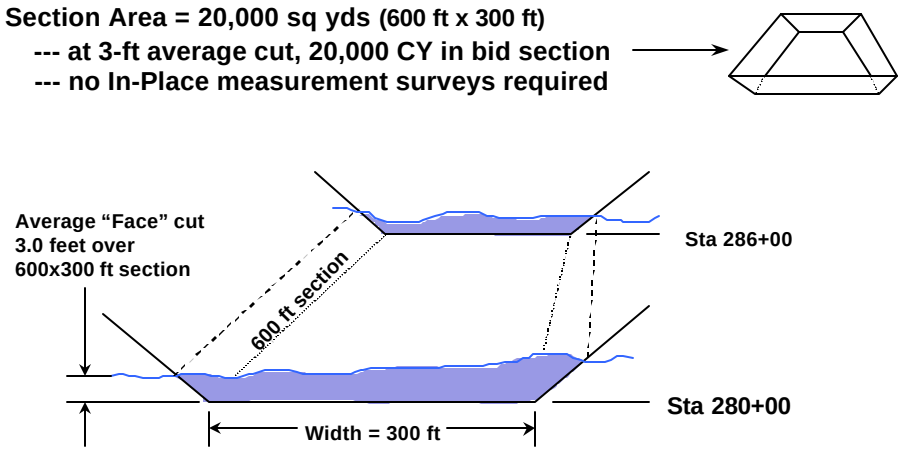

Figure 14-3: Station Dredging

c. Unit price--time measure. This type of dredging is performed when the quantities of material cannot be accurately estimated by in-place volume survey methods, such as in active or erratic shoaling areas, or where rapidly fluctuating river stages exist, or where "accurate and timely surveys are difficult to accomplish" (from ER 1130-2-520). Dredging plant and equipment is leased at an hourly or daily rate bid by the contractor. On these types of contracts, hydrographic survey accuracy requirements are not as demanding as in-place payment methods--usually due to high shoaling rates encountered. However, daily survey support is required to monitor channel dimensions and overall contract compliance. These contracts are common on the lower Mississippi River.

d. Unit price--scow or bin measure. Payment based on scow or bin measure, and/or related production/density flow meters, require final after-dredging hydrographic surveys to certify clearance and contract acceptance. In addition, hydrographic surveys are needed to determine the amount of any excess dredging; for a payment reduction. Related hydrographic surveying and electronic positioning is usually required for monitoring the placement of dredged material in open water.

e. Firm Fixed price--lump sum contracts. This method is used on maintenance work where the rate of shoaling is small or predictable over the length of the contract. In this method the dredge contractor bids a lump sum price for the job based on the contract plan and specification surveys. No pre-dredge survey need be performed; however, after-dredge clearance and acceptance surveys are required to ensure the contractor has removed all material from the required prism.

14-6. Dredged Material Payment Prisms

Hydrographic surveys supporting dredging operations, and related dredge volume and payment computations, are performed with respect to a variety of payment prisms. Survey data must be collected at sufficient accuracy and density so it can be evaluated relative to these prisms. Failure to collect survey data with sufficient coverage makes accurate pay quantity computation difficult, and can result in payment disputes. The following parameters are used to define the various payment reference surfaces found on navigation projects. Refer back to Figure 14-1 for a graphical depiction of the following prisms.

a. Authorized project dimensions. A channel's "required depth" or "project depth" and width are specified in the Congressional authorizing legislation for each project. This legislation may also detail the dimensions of channel entrances, bends (wideners), sidings, anchorages, and turning basins. The required project depth (authorized project depth) is based on the draft of the loaded design vessel plus, squat, sinkage in fresh water, effect of wind and wave action, under-keel safety and efficiency clearance, etc.--see ER 1110-2-1404 (1997), "Hydraulic Design of Deep-Draft Navigation Channels." Project width of a channel is a function of traffic, winds, currents, curvature, vessel maneuverability, bank conditions, etc. See Figure 14-4. In some instances, over-width dredging may be performed for advance maintenance purposes--EM 1110-2-1202, "Environmental Engineering for Deep-Draft Navigation Projects."

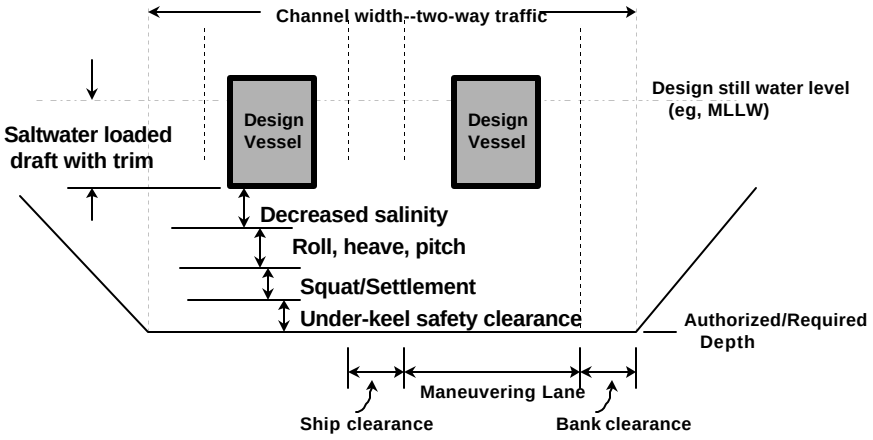

Figure 14-4: Typical Deep-Draft Navigation Channel Dimension and Clearance Parameters

b. Allowable overdepth. Dredging below the required project depth prism is permitted (and paid) to allow for inaccuracies in the dredging process. This is called the "overdepth allowance." A maximum two-foot overdepth is typically allowed for coastal, Great Lakes, and inland waterway projects. Payment is made for material excavated above both the required depth and the allowable overdepth grade. In some cases, no overdepth allowance is paid--termed "zero tolerance" dredging. In such cases, surveys must assure that the contractor has dredged below the required depth to ensure all material has been removed .

c. Required overdepth. On newly constructed channels where hard material exists (e.g., rock, dense clays), a required depth prism, a required overdepth prism, and an allowable overdepth prism will be specified in the dredging contract.

d. Advance maintenance dredging. In areas where fast shoaling occurs, an additional advance maintenance dredging depth may be allowed--see Figure 14-1. Overdepth dredging below this prism may also be allowed. Advance maintenance dredging is not usually allowed for removal of rock, or to provide navigation channel dimensions for vessels that exceed the design limitations of a project.

e. Channel side slopes and box cut allowances. Side slope grades are designed based on the geophysical properties of the material on the channel banks. Side slope grades typically vary between from 1 on 1 (45 deg) up to 5 on 1 (11 deg). Advance maintenance and overdepth payment prisms are extended up the side slopes parallel to the authorized project depth prism, and payment may be allowed for material removed within these sections. In some instances, allowance may be made for material excavated below the payment prism based on the potential for undisturbed material to slough downward to the channel toe. This is commonly referred to as a "box cut allowance"--see Figure 14-5.

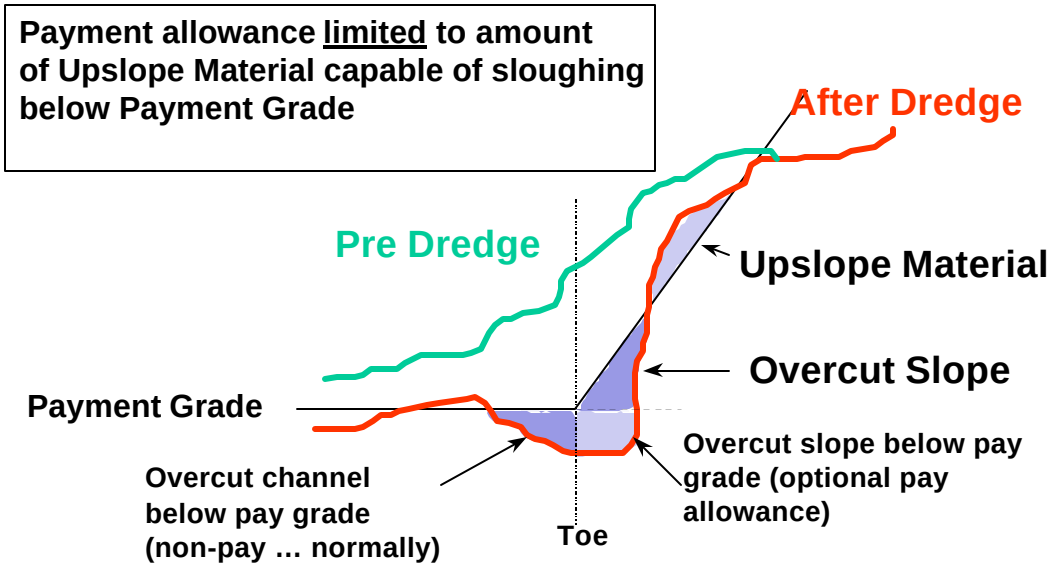

Figure 14-5: Box Cut Payment Method

f. Corps-Wide variations. Dredging payment prisms are not fully standardized among the Corps districts or their subordinate area offices. A number of local restrictions are placed on allowable payment within a dredged section. Volume computations use the "Standard Payment Method" or the "Contour Method" and variations within these methods, as described in the chapter on dredge volume computations. Some Corps offices make no pay allowance for side slope dredging and/or box cut excavation, or may place

other limits on pay allowances. These variations require like variations in the analysis of hydrographic survey data and the method by which final payment quantities are computed.

g. Volume computation techniques. The "Average End Area" (AEA) method is used by most Corps offices to compute payment volumes for contract dredging work. Although this method is well known to be only an approximation, and contains biases, its use is widely accepted within the Corps and the dredging industry. Of late, some districts are beginning to compute volumes obtained directly from digital elevation models in a CADD environment--e.g., triangulated irregular network (TIN) surface volumes. However, these more advanced methods have been rarely used in contract payment given Corps and industry reluctance to deviate from the "traditional" average end area approximation. With the advances in electronic technology, survey methods and practices will gradually migrate away from the AEA method.

14-7. Other Factors Impacting Measurement and Payment Surveys

A number of factors will determine the ultimate accuracy requirements for a particular hydrographic survey supporting a dredging operation. These include:

a. Type of excavated material. The type of excavated material (including its disposal) will impact required survey accuracies. Areas with hard material, such as rock, may require blasting which could result in numerous rock fragments remaining above project grade by small amounts (e.g., 0.1 ft to 0.5 ft). Accurate acoustic or mechanical sweep surveys will be performed to locate these fragments and excavate or drag them clear.

b. Unit price. The bid unit price may impact accuracy requirements in a number of ways. High unit price material obviously requires more accurate surveys and/or volume computations. The unit price will also determine whether it is cost-effective for the contractor to dredge close to the required depth or to dredge significant amounts of overdepth material. When economics dictate that overdepth dredging is not economical, dredging close to the required depth can result in many remaining areas left above grade, and resultant disputes.

c. Dredge equipment. The type of dredging equipment used may impact the accuracy requirements for a hydrographic survey. In the Corps, removal of loose materials is normally accomplished by suction dredging (dustpan dredges, hopper dredges, hydraulic pipeline suction dredges, or sidecasters). Since these types of dredging operations are not as precisely controlled (in depth and location), survey accuracy and density of coverage may be reduced. For removal of hard, compacted material (e.g., rock), mechanical dredging is performed, using clamshell, dipper, or ladder dredges. This is typical of new work. A cutterhead dredge (combined suction and mechanical) is employed for either soft or hard material. Survey accuracy requirements are generally higher for mechanical or cutterhead dredge equipment since these operations can fairly precisely control the location and depth of cut. See also EM 1110-2-5025, "Dredging and Dredged Material Disposal."

d. Physical site conditions. Interference with marine traffic and navigation congestion in the waterway, height obstructions such as bridges, towers or high rise buildings, and other natural phenomena must be considered for complete survey accuracy.

14-8. Measurement, Payment, Performance, and Acceptance Surveys

The following excerpts are taken from clauses contained in most dredging contracts involving payment based on hydrographic surveys. These contract requirements have significance to the survey measurement process, both procedurally and technically, and the interpretation of the adequacy of Corps survey data.

Although the government, as the contracting agent, developed these clauses to protect the government's interests, they also provide mechanisms for the contractor to challenge the government's interpretations and assessments, and obtain relief if necessary. Contract clauses are continually changing; therefore, the abbreviated excerpts below may not be current. The full contract clause may be obtained in the applicable procurement regulation.

a. Survey errors. Contract acceptance clauses provide for a contractor to challenge the accuracy of any payment survey based on a "obvious error" in that survey. "Obvious error" provides extremely wide latitude for alleged survey deficiencies in that no specific magnitude of the error is defined; thus, this clause is frequently invoked by dredging contractors. However, by implication, any allegations of "obvious error" must relate to recognized survey standards and practices--i.e., conformance or non-conformance with the criteria in this engineer manual. See also "Board of Contract Appeals: Decision in the Appeals of Cottrell Engineering Corporation," (1997). The contractor has the burden of documenting the alleged survey deficiency, based on observed non-conformance with standard practice or inconsistencies in the data relative to independent measurements. Government-performed surveys, and assessments or evaluations thereof, must always be "above board" and performed in a manner that both represents the government's interests and is equitable to the contractor for the actual work performed under the contract.

> "Surveys for Acceptance: ... the [Plans & Specifications hydrographic survey] drawings are believed to accurately represent conditions existing at the time indicated but the depth shown thereon will be updated as required by [Pre Dredge] soundings taken prior to commencement of dredging. Determination of quantities removed to be paid for in the areas specified, after having once been made, will not be reopened, except on evidence of collusion, fraud, or obvious error ... The time for redredging to remove shoals and for [second] [third] and subsequent [hydrographic] surveys shall be the responsibility of the contractor."
>
> "… Final Examination and Acceptance: As soon as practicable after completion of the entire work or any section thereof ... such work will be thoroughly examined at the cost and expense of the Government by sounding or sweeping, or both, as determined by the Contracting Officer. Should any shoals, lumps, or other lack of contract depth be disclosed by this examination the Contractor will be required to remove same by dragging the bottom or by dredging at the contract rate for dredging, but if the bottom is soft and the shoal areas are small and form no material obstruction to navigation, the removal of such shoal may be waived by the discretion of the Contracting Officer. The Contractor will be notified when soundings and/or sweepings are to be made, and will be permitted to accompany the survey party. When the area is found to be in a satisfactory condition, it will be accepted finally. Should more than two sounding or sweeping operations by the Government over an area be necessary by reason of work for removal of shoals disclosed by a prior sounding or sweeping, the cost of such third and any subsequent sounding or sweeping operations will be charged against the Contractor. The rate for each day in which the Government [survey] plant is engaged in such sounding or sweeping operations and/or is en route to or from the site, or is held, for the Contractor's convenience at or near the site for these operations, shall be [$800.00]*, except on Saturday, Sunday and holidays when the rate shall be [$1,000.00]…"

b. Remaining shoals. The above excerpt from a typical acceptance clause provides latitude to the government in assessing the significance of remaining shoals. This assessment will evaluate the magnitude of the shoal relative to the achievable survey tolerances, achievable dredging tolerances, and/or navigation impacts. Obviously, the positional and depth measurement accuracy tolerances of a survey must be thoroughly considered before a contractor is directed to undertake additional work at his time and expense--see Figure 14-6. Note also that the contractor is liable for the costs of repeated survey effort.

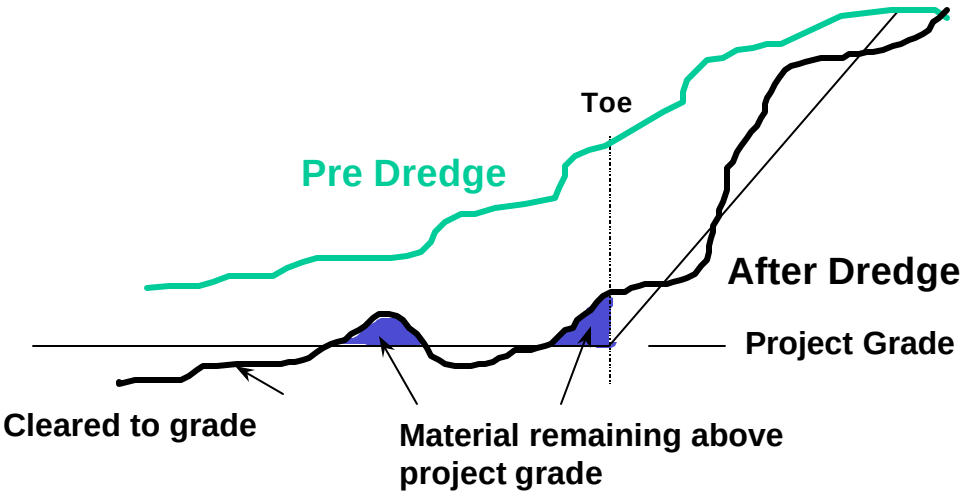

Figure 14-6. Channel clearance along toes

The Contracting Officer has authority to unilaterally direct a contractor to continue dredging any disputed shoal material under the Disputes clause, which reads in part:

> " …This contract is subject to the Contract Disputes Act of 1978 ... The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer. …"

The Disputes clause allows the contractor to recover costs for the additional work if it can be later proven (by the contractor) that the Contracting Officer's directive to proceed with the work was based on erroneous or unreliable hydrographic survey data. Thus, it is imperative that the Contracting Officer be provided with high quality and technically defendable survey information when such unilateral directives must be made. This is especially critical in that the cost of litigated disputes (i.e., interest, attorney fees, etc.) may far exceed the cost of the actual work in dispute.

> " …Inspection of Construction: ... the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract ... Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under warranty or guarantee …"

The above part of the Inspection clause requires the Corps to perform final (After-Dredging) acceptance surveys as expeditiously as practicable, and to release the contractor's dredge from the work. This clause also is applicable in cases where fraudulent work may have been performed. In the past, numerous cases exist where dredging was performed only on the even 100-ft stations/sections surveyed by the Corps (usually by manual tagline/leadline techniques), and no material was excavated between the sections. Often this fraudulent work was not discovered until long after the work was accepted. Such incidents are rare today given full-bottom sweep capabilities of modern survey equipment.

c. Survey certification. In most districts, a dredging contractor's representative is requested and/or required to be aboard the government vessel requested and/or required to be aboard the government vessel performing payment surveys. The intent of this requirement is to resolve any problems with the survey while still on site. The representative may be asked to certify the survey. The following is an example of clauses used by the Jacksonville District to fulfill these requirements.

General
The Contracting Officer shall be notified, in writing, three (3) weeks in advance of the need for pre-dredging and after-dredging surveys. Surveys will be performed in accordance with paragraph "Quantity Surveys" of SECTION 00800; SECTION 01450: CONTRACTOR QUALITY CONTROL; Engineering Manual (EM) 1110-1-2909 dated 1 July 1998 "Geospatial Data and Systems"; and, Engineering Manual (EM) 1110-2-1003 dated 31 October 1994 entitled "HYDROGRAPHIC SURVEYING." A copy of the EM's will be available for review by prospective bidders during the bid period or can be viewed or downloaded at http:www.usace.army.mil/inet/usace-docs/eng-manuals. A copy of the EM's will be provided to the Contractor at the pre-work conference.

Contractor Representative
All in-place measurement surveys and final acceptance sweep surveys will be performed with a representative of the Contractor on board the Government platform during the full execution of the survey. No in-place measurement or final acceptance survey will be performed without a representative of the Contractor on board the survey vessel. The Contractor's representative shall be fully knowledgeable in offshore construction subsurface surveying procedures, techniques, equipment, and horizontal and vertical calibration methods, and state-of-the-art horizontal and vertical accuracy limitations. The Contractor's representative shall observe and review, in progress, the adequacy and accuracy of the survey for in-place payment purposes, and for the potential existence of collusion, fraud, or obvious error in the data.

Survey Certification
Immediately upon completion of any survey, the Contractor's representative shall, based on his onsite review of the survey execution, determine that the survey contains no evidence of collusion, fraud, or obvious error, and that subsequent horizontal and vertical corrections are accurately annotated on the subsurface record.

The Contractor' authorized representative shall bring aboard the survey vessel a blank copy of the Certification Statement and shall attest to an acceptable survey by signing the Certification Statement before leaving the vessel. Sample copy of the Certification Statement is appended to the end of this section.

In the event the Contractor's authorized representative observes (and quantifies) specific documentary evidence of either fraud, collision, or obvious error, the survey will be immediately rerun. Resurveys will totally supersede any previously run survey and will be run over the full reach of any particular Acceptance Section or transit or pipeline route..

If acceptability is not acquired after performing one resurvey of an Acceptance Section, a meeting shall be held between the Contractor and the

Contracting Officer's Representative to expeditiously resolve the issue causing rejection of the survey. Contractor equipment and personnel standby time to resolve acceptability of the survey shall be at the Contractor's expense.

In no case shall a previously unacceptable survey be later judged acceptable by the Contractor; unless such a reassessment/reevaluation is performed within 24 hours after the original survey, and prior to initiating any resurvey action based upon identifiable collusion, fraud, or obvious error.

Should the Contractor or his authorized representative refuse to certify to the acceptability of a survey for contract payment without identifiable collusion, fraud, or obvious error, then the following actions will follow:

a. Preconstruction (pre-dredging) Survey. Excavation shall not commence until representatives of the Contractor and Contracting Officer have met and resolved the basis for refusal of certification. Should the Contractor commence excavation prior to obtaining an acceptable survey, he shall be liable for any excavation performed. If a resurvey is performed, and accepted, prior excavation will not be measured, estimated, or paid for.

b. Postconstruction (after-dredging) Survey. The 3-week survey window allowed under paragraph "Measurement" above, will be indefinitely extended until a final survey is accepted. Any material accretion which might occur due to such a time extension will neither be measured, estimated, or paid for.

c. Contractor equipment and personnel standby time to resolve his refusal to certify to the acceptability of a survey when there is no identifiable collusion, fraud, or obvious error shall be at the Contractor's expense and resultant delays shall not be the basis for time extensions of the contract.

CERTIFICATION STATEMENT
CONTRACT: ____DACW_____
ACCEPTANCE SECTION/SURVEY:
_____
REFERENCED SOURCE DOCUMENT:
_____

I have fully observed the performance of the subject survey and have determined, based on my review of the referenced source document record, that the data contains no evidence of collusion, fraud, or obvious error. The recorded data, including calibration corrections thereto, have been obtained in accordance with the systematic/procedural methods and techniques described under SECTION 02325: DREDGING of the contract specifications, that all known and unknown systematic and random errors have been minimized consistent with: (1) The relative precision levels of the equipment utilized; and, (2) Absolute accuracies expected (or likely) given current (state-of-the-art) horizontal and vertical measurement limitations associated with offshore survey systems, procedures, and related variables; and, as such, the observed/recorded data are fully and finally acceptable for determining and measuring contract performance and payment.

AUTHORIZED REPRESENTATIVE: _____
/s/ _____
TITLE: _____
DATE: _____

CF:
Contractor Representative
Area Office

14-9. Measurement and Payment Surveys Performed by Other than Corps Hired-Labor

On most projects, quantity survey measurements are performed by Corps hired-labor (in-house) survey forces. However, over the past 15 years, there has been an increasing trend to contract out these payment surveys. This is primarily due to decreased government manpower allocations. Often there are insufficient Corps survey personnel to cover surveying requirements for many on-going construction and dredging contracts. Many contracts (e.g., beach renourishment and revetment construction) require full-time survey capability throughout the construction season; thus, it is more efficient to contract this effort.

a. When necessary, either independent A-E contractors or dredge contractor survey forces may be used in lieu of Corps surveyors. Corps policy regarding contracting measurement and payment surveys is prescribed in EP 1130-2-520. Basically, surveys may be performed using (1) USACE hired-labor forces, (2) Architect-Engineer (A-E) service contractor forces selected using Brook's A-E Act (PL 92-582) qualification-based selection procedures, or (3) Dredge contractor forces, provided a qualified government representative is on board the contractor's vessel during the surveying operation.

b. Corps policy clearly outlines a preference for performing surveys with Corps forces. This policy is justified in that payment and project clearance/acceptance is based on these surveys, and any disputes (between the Corps and construction contractor) over survey adequacy or accuracy become difficult to resolve unless the contract agent is fully responsible for the survey data. Reduced manpower is making this

ideal situation less common; thus, more reliance is being made on A-E firms and construction contractors to perform payment surveys.

c. The use of construction/dredging contractors performing their own payment surveys represents a special case, given the need for quality assurance oversight that must be performed by the Corps when such surveys are performed. Corps policy (in EP 1130-2-520) outlines steps that must be taken when a district elects to use dredge contractor forces for hydrographic payment/acceptance surveys. Basically, districts must provide a rationale and justification for proposing to use dredge contractor's surveys forces and document their unsuccessful efforts to obtain contracts with qualified independent A-E hydrographic survey firms. Districts may require a contractor's surveyor be a licensed land surveyor or hold hydrographer certification from the American Congress on Surveying and Mapping. Certain minimum equipment specifications may also be required in the dredging contract.

d. Most dredge contractors normally have survey forces on the project to perform progress payment surveys, and these same forces can be used for payment and acceptance surveys as well. In some instances, dredge contractors will subcontract their hydrographic survey work. Although Corps policy requires surveying and mapping services to be procured using Brooks A-E Act methods, dredging contractors cannot be directed to follow these procedures when selecting subcontractors for this work.

e. Overall, the majority of districts still conduct payment and contract acceptance surveys with their own in-house forces. With declining manpower allocations, there is a definite trend towards contracting an increasing amount of these services. These trends are most noticeable in Alaska and California, and in some districts in the Southeast and Gulf Coasts.

14-10. Unconsolidated Sediments (Fluff) on Dredging Projects

One of the most difficult issues in evaluating hydrographic survey data occurs when low-density suspended sediments obscure the echo sounding return. This phenomena, commonly know as fluff, occurs in the natural low-flow environments and may also occur during dredging operations due to the agitation of the bottom material. It is most pronounced in southeastern U.S. navigation projects. Multiple layers of fluff can occur, with these layers ranging from 1 to 15 feet above the bottom. Assessment of dredging progress, clearance above required depth, and the equitable payment grade can be extremely difficult--even when dual frequency sounders are used, or when correlation is made with non-acoustic devices (lead lines, sounding poles, nuclear density probes, etc.). As a result, contract payment techniques based on in-place volume measure can often be difficult and may require negotiated settlement. In some instances, after dredge surveys have shown more material in a channel than before dredging surveys. Certification of the clear navigable depth may also be tenuous where the firm channel bottom cannot be clearly determined. Procedures for performing and evaluating surveys in unconsolidated sediments are described in a later chapter in this manual.

14-11. Ocean Disposal Positional Monitoring

Platforms used for transporting excavated material to offshore disposal sites are usually continuously monitored for position and draft changes. Hopper dredges working in environmentally sensitive channels are also monitored throughout the work period. Various automated systems have been developed to position barges and dump scows en route and over submergent disposal areas. Standard Positioning Service (SPS) DGPS positional accuracy is usually adequate. The following clauses are representative of those used for disposal area positional monitoring and hopper dredge monitoring.

Electronic Tracking System (ETS) for Dredging and Ocean Disposal Vessels

The Contractor shall furnish an Electronic Tracking System (ETS) for surveillance of the movement and disposition of dredged material during excavation, ocean transit and beach disposal. This ETS shall be established, operated and maintained by the Contractor to continuously track in real-time the horizontal location and draft condition of the disposal vessel for the entire dredging cycle, including dredging area and disposal area. The ETS shall be capable of displaying and recording in real-time the disposal vessel's draft and location in an acceptable coordinate system which can be related to, or is directly based on the appropriate state plane coordinate system every 500 feet (at least) during loading cycle and during travel to disposal area, and every minute (at least) or every 200 feet of travel, whichever is smaller, while approaching within 1000 feet and within limits of disposal area.

ETS Standards

The Contractor shall provide an automated (computer) system and components to perform in accordance with EM 1110-1-2909. A copy of the EM will be made available at the District Office for review by prospective bidders during the bid period or can be downloaded at http://www.usace.army.mil/inet/usace-docs/eng-manuals. A copy will be provided to the Contractor at the Pre-Construction Conference. Horizontal location shall have an accuracy equal to +/- 10 feet (horizontal repeatability). Vertical (draft) data shall have an accuracy of +/- 0.5 foot. Horizontal location and vertical data shall be collected in sets and each data set shall be referenced in real-time to date and local time (to nearest minute), and shall be referenced to the same state plane coordinate system used for the survey(s) shown in the contract plans. The ETS shall be calibrated as required, in the presence of the COR at the work location before disposal operations have started, and at 30-day intervals while work is in progress. The Contracting Officer shall have access to the ETS in order to observe its operation. Disposal operations will not commence until the ETS to be used by the Contractor is certified by the COR to be operational and within acceptable accuracy. It is the Contractor's responsibility to select a system that will operate properly at the work location. The complete system shall be subject to the Contracting Officer's approval.

Data Requirements and Submissions

All data shall be collected and stored on 3-1/2 inch disks or CD-ROM in ASCII format using IBM-compatible MS-DOS 5.0 or later version. Data shall include date, time, trip ID number, vessel name and name of vessel's captain, location and draft of disposal vessel every 500 feet (at least) during loading cycle and during travel to disposal area, and every minute (at least) or every 200 feet of travel, whichever is smaller, while approaching within 1000 feet and within limits of disposal area. Data collected while the disposal vessel is in the vicinity of the disposal area shall also be plotted in chart form, in 200-foot intervals, to show the track and draft of the disposal vessel approaching, traversing, and leaving the disposal area. More than one

disposal area trip may be stored on a single disk or CD ROM as long as trip data is indexed and clearly identifiable. The completed, original disk or CD-ROM shall be furnished to the COR within 24 hours. Plotted charts shall be organized and maintained at a central work location for inspection on a daily basis by the COR. Plotted charts shall be organized as directed, bound and submitted weekly to COR for permanent file record.

ETS

The ETS for each disposal vessel shall be in operation for all dredging and disposal activities and shall record the full round trip for each loading and disposal cycle. The Contracting Officer shall be notified immediately in the event of ETS failure and all dredging operations for the vessel shall cease until the ETS is fully operational. Any delays resulting from ETS failure shall be at the Contractor's expense.

Recording Charts for Hopper Dredge(s)

All hopper dredge(s) shall be equipped with recording devices for each drag head that capture real time, drag head elevation, slurry density, and at least two of the following: Pump(s) slurry velocity measured at the output side, pump(s) vacuum, and/or pump(s) RPM. The Contractor shall record continuous real time positioning of the dredge, by plot or electronic means, during the entire dredging cycle including dredging area and disposal area. Dredge location accuracy shall meet the requirements of the latest version of EM 1110-2-1003.

The recording system shall be capable of capturing data at variable intervals but with a frequency of not less than every 60 seconds. All data shall be time correlated to a 24 hour clock and the recording system shall include a method of daily evaluation of the data collected. Data shall be furnished to the Contracting Officer's Representative for each day's operation on a daily basis. A written plan of the method the Contractor intends to use in order to satisfy these requirements shall be included with the Contractor's Quality Control Plan.

14-12. Mandatory Requirements

There is no mandatory guidance in this chapter.